

I claim:

1. An uninterruptible switching power supply device, comprising:
  - a main transformer (200) having a primary winding (201) and a secondary winding (202);
    - 5 a high voltage switching circuit (10) comprising a DC high voltage bus (108), a high voltage switch (109), and an AC input power being coupled to the primary winding (201) through a rectifying circuit (103) and said DC high voltage bus (108);
      - 10 at least one low voltage switching circuit (20) comprising a battery (400), a low voltage switch (402) being coupled to the positive pole of the battery (400) through a diode (401), and a tap L from the secondary winding (202) of the main transformer (200); and
        - 15 a pulse width modulator unit (302) for controlling the high voltage switching circuit (10) and the low voltage switching circuit (20) to operate synchronically.

2. An uninterruptible switching power supply device according to claim 1, wherein the number of turns  $N_L$  from said tap L to the reference ground is determined by the following equation:

$$N_L = V_{B\max} N_H / V_{H\min}$$

wherein  $V_{B\max}$  is the maximum discharging voltage of the battery (400) at the tap L,  $V_{H\min}$  is the minimum AC voltage when the battery begins to discharge, and  $N_H$  is the number of turns 20 of the primary winding (201) of the main transformer (200).

3. An uninterruptible switching power supply device according to claim 2, wherein one end of said DC high voltage bus (108) is coupled to said AC input power through a protection circuit (101), a filtering circuit (102) and said rectifying circuit (103) in turn, and the other 25 end of the bus (108) is coupled to one end (M) of the primary winding (201) of the main transformer (200).

4. An uninterruptible switching power supply device according to claim 3, wherein the DC high voltage bus (108) further comprises a power factor correction circuit (110) connected 30 between the rectifying circuit (103) and the primary winding (201) of the main transformer (200) through a diode (106).

5. An uninterruptible switching power supply device according to claim 3, wherein said

protection circuit (101) comprises a fuse, a surging current suppressor, or a surging voltage suppressor, or a combination thereof.

6. An uninterruptible switching power supply device according to claims 2, further  
5 comprising a charging/auxiliary power source (900) being coupled to said DC high voltage  
bus (108) for charging the battery (400) and providing a back-up power for a load.

7. An uninterruptible switching power supply device according to claim 2, further  
comprising a high voltage DC generation circuit including a conversing rectifying means (107)  
10 and a filtering capacitor (105) connected to one end of the primary winding (201).

8. An uninterruptible switching power supply device according to claim 2, further  
comprising a DC high voltage output unit including an AC detection circuit (801), an isolation  
optical coupler (802), a comparator (803) and a relay (800) being connected in series for  
15 switching AC output of the relay to DC output when the voltage of the AC input is lower than  
a predetermined value.

9. An uninterruptible switching power supply device according to claim 2, further  
comprising an isolation transformer (301) through which the PWM unit (302) controls the  
20 high voltage switch (109) and the low voltage switch (402) to operate synchronically.

10. An uninterruptible switching power supply device according to claim 2, further  
comprising an interface (700).

25 11. A method for uninterruptibly switching from an AC input power to a DC power to  
energize a load during the brown-out or failure of the AC input power in an uninterruptible  
switching power supply device comprising a high voltage switching circuit being coupled to  
the primary winding of a main transformer, at least one low voltage switching circuit  
including a tap L on the secondary winding which is connected to a battery through a low  
30 voltage switch, and a PWM unit for controlling the high voltage switching circuit and the low  
voltage switching circuit to operate synchronically, said method comprising the following  
steps of:

a) detecting the AC input and comparing the voltage of the AC input with a

predetermined value; and

b) selectively driving the high voltage switching circuit and the low voltage switching circuit to operate according to the result of the step a) so that the AC input power and the DC power source can be selectively transformed by the main transformer to energize the load.

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12. A method according to claim 11, wherein, when the step a) shows that the AC input is higher than or at least equals to a predetermined value, the AC input is transformed by the main transformer to generate an inductance voltage on the secondary winding of the transformer for powering a load.

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13. A method according to claim 11, wherein, when the step a) shows that the voltage of the AC input is lower than the predetermined value, the high voltage switching circuit and the low voltage switching circuit are operated synchronically under control of the PWM unit, and the discharge of the battery is connected with the tap of the secondary winding of the transformer so as to generate a power for compensating the reduced AC power.

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14. A method according to claim 11, wherein, when the step a) shows that the AC input equals to zero, the discharge of the battery is coupled to the tap of the secondary winding of the transformer to generate a power for energizing a load.

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15. A method according to claim 11, wherein the PWM unit is controlled by a central control unit so that the duty cycle of the PWM unit can increase in accordance with the decline of the discharge of the battery.

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